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(54) Endoscope.

(57) A sterilizable endoscope of small diameter has a central coherent fibre bundle for carrying an image to a viewing means, and the fibre bundle is surrounded by light fibres. The proximate end of the endoscope is provided with a coupling means (14) for aligning the coherent optical bundle with the optical system of the viewing means and for providing an interface with light transmitting means to transmit light from a light source along the light fibres to a body cavity to be inspected. The coupling means (14) may have a diameter no bigger than the diameter of the covering of the endoscope. When the endoscope is used inside a larger endoscope or a trochar, the latter can be removed while the former remains in place. This is accomplished by removing the viewing means and sliding the larger endoscope or trochar over the other endoscope and then replacing the viewing means for further viewing within the body cavity. The device can be used for detection of cancer cells and treatment thereof by phototherapy. A dye is attached to the tissue being examined and subsequently exposed to an exciting laser light frequency. Cancer cells will emit fluorescent light which is detected and displayed on the video monitor and the same light frequency is then transmitted through the light fibres to the cell for phototherapy treatment.

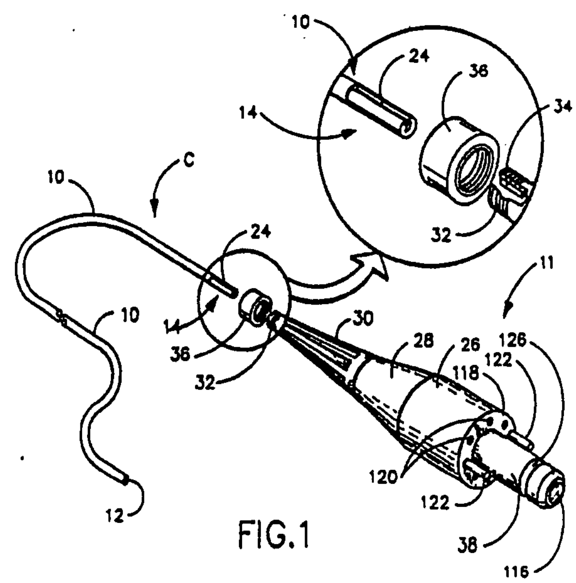


FIG.1

ENDOSCOPE

This invention relates to small diameter endoscopes and more particularly to such an endoscope having a coupling means on the proximate end for releasable attachment to viewing means for viewing by the surgeon such as on a video screen or monitor for example. In an emergency, the endoscope may be attached to an eyepiece.

Prior to this invention, light beams have been used both for illumination and for treatment of disease in patients. However, all of these instruments have had eyepieces when utilized with visible light.

U.S.-A-3 858 577 to Bass, et al. discloses an endoscope of substantial size for performing laser surgery. In this device, conventional light is used through fibre optics to illuminate the operating site and laser light is used to perform a surgical procedure.

U.A.-A-4 011 403 to Epstein, et al. discloses a fibre-optic laser endoscope. The device utilizes a laser beam as a light source and an optical fibre as a light transmitter. The sensing means includes a TV camera located at the investigated site. The laser beam produces radiation at three different wavelengths which produce white light. Ultraviolet or infrared light can also be used. The camera is separate from the fibre-optics and the laser.

U.S.-A-14 313 431 to Frank discloses an endoscope using a laser light source with a light-conducting fibre. This device is used for irradiating bladder tumours utilizing the laser light beam.

In the invention set forth in U.S.-A-4 589 404 to Barath, et al., and assigned to the present Applicants, an endoscope, having a micro-thin diameter, is provided having an interface connector at the proximate end thereof for removably plugging into a receptacle in a video monitor. Thus, the endoscopes can be separately sterilized and can be easily replaced should it become damaged. However, if a power interruption should occur or a malfunction cause the monitor not to work properly, the endoscope disclosed in that patent can no longer be used to complete the operation. This necessitates removal and replacement of the endoscope with another one having an integral eyepiece for viewing the body cavity. This requires extra time and inconvenience and is not desirable from the standpoint of the surgeon or the patient. It also produces only a black and white image.

Another device which is currently available is an imaging lavage endoscope sold under the trademark VISICATH by Microvasive of Milford, Massachusetts, U.S.A. This device has an eyepiece with a separable endoscope so that the endoscope can be replaced, should it become damaged. This results in a cost saving since the eyepiece does not have to be replaced. Both the eyepiece and the endoscope are sterilizable. The eyepiece is not usable with a console. Thus, in the use of this device the sterility is destroyed as soon as the physician puts the eyepiece against his face.

An eyepiece requires an optical light cable to transmit light from a light source to the endoscope. Each manufacturer of optical light cables supplies them with different sized fittings at each end. This results in confusuib and frustration in the operation room in trying to find an optical light cable whose fittings match with those of the light source and the eyepiece.

According to the invention, there is provided a sterilizable small diameter endoscope for viewing and/or treatment within body cavities by nonsurgical or micro-surgical procedures and having a distal end for insertion into a body cavity and a proximate end, said endoscope being characterised by a coherent fibre optical bundle having a micro-thin diameter and extending from said distal end to a point adjacent said proximate end and having a planar surface at its proximate end, a plurality of light transmitting fibres spaced around said optical bundle, a tubular outer cover extending over said fibres to hold them in place, said outer cover extending from said distal end to a point spaced from said proximate end, optical lens means at said distal end of said optical bundle to focus an image of a portion of the cavity on said distal end of said optical bundle for transmission through said optical bundle, and a coupling means for removably connecting the endoscope to a viewing means in fixed angular relationship, the coupling means being fixedly attached to said proximate end of said endoscope and having a diameter no larger than the diameter of said outer covering so that the endoscope can pass completely through a trochar lumen or operating channel of a larger endoscope.

According to the invention, there is also provided a method of using a sterilizable endoscope for viewing and/or treatment within body cavities by nonsurgical or micro-surgical procedures which has a distal end for insertion into the body cavity and a proximate end with coupling means of no greater diameter than the body of the endoscope, said method being characterised by the steps of inserting the distal end into the body cavity, attaching a first removable optical viewing means to the coupling means to view the body cavity, disconnecting the first removable optical viewing means from the coupling means, and attaching a second removable optical viewing means to the coupling means to

view the body cavity.

According to the invention, there is further provided a method of detecting abnormal cells in a patient, characterised by the steps of giving the patient a fluorescent drug which localizes in the abnormal cells, irradiating the body area containing the abnormal cells with a light of a first frequency which will cause the abnormal cells to fluoresce, and treating the abnormal cells by irradiating them with laser light of a second frequency to destroy the abnormal cells.

Endoscopes embodying the invention and methods according to the invention of using endoscopes and detecting abnormal cells in a patient will now be described by way of example, with reference to the accompanying drawings in which:-

Figure 1 is a perspective view of one of the endoscopes showing specific details of the coupling means and the eyepiece;

Figure 2 is a fragmentary side elevation of one configuration of an eyepiece showing the interconnection of the endoscope and the optics within the eyepiece;

Figure 3 is a perspective view showing the use of one of the endoscopes with a trochar which is inserted into a body cavity and is used with a console;

Figure 4 is an enlarged cross-section of the distal end of one of the endoscopes;

Figure 5 is a perspective view of one of the endoscopes used with a maleable sheath in a multilumen trochar;

Figure 6 is an enlarged cross-section, taken along line 6-6 of Figure 5 showing the end of the endoscope when used in a multilumen trochar;

Figure 7 is a front elevation of a console and video monitor connected to the endoscope;

Figure 8 is a diagrammatical plan view of the interior construction of the console of Figure 7;

Figure 9 is an enlarged longitudinal section through the socket of the monitor and the strain relief unit of the endoscope showing the interconnection between the two;

Figure 10 is a similar section through an eyepiece showing the interconnection between the eyepiece and the strain relief portion of the endoscope;

Figure 11 is a vertical section, taken along line II-II of Figure 10, showing the spring detent for holding the strain relief unit in position;

Figure 12 is a perspective view of one of the endoscopes with a general purpose rigid examining tip on the distal end;

Figure 13 is an enlarged longitudinal section, taken along line 13-13 of Figure 12, showing details of the end construction;

Figure 14 is a perspective view of one of the endoscopes, this endoscope being similar to the one shown in Figure 12 but which has a stainless steel sheath on the distal end which may be either rigid or maleable;

Figure 15 is a perspective view of one of the endoscopes, this one being similar to the one shown in Figures 12 and 14 but having an optical probe at the distal end of the endoscope; and

Figure 16 is a perspective view of one of the endoscopes, similar to that shown in Figures 12,14 and 15, but having the distal end in a protective tube attached to grasping jaws of a pair of forceps.

As shown in Figure 1, a sterilizable small diameter endoscope C includes a cable assembly 10 which is provided at its distal end with a lens 12 and at its proximate end with a coupling means 14. Turning to Figure 4, an enlarged cross-section of cable assembly 10 is shown. At the centre of the cable is a coherent fibre-optical bundle 16. A tubular inner cover 18 extends around coherent optical bundle 16 at each end and may be formed of a heat shrinkable Teflon (trade mark) of PVC material which extends along the coherent optical bundle from the distal end to the proximate end. Placed around inner covering 18 is a plurality of light carrying bundles 20 which are made up of individual fibres which do not have to be coherent. These bundles are for transmitting light from a suitable light source to the body cavity. Alternatively, bundle 20 may be replaced with a single flexible glass fibre. An outer cover 22 extends around the spaced light bundles 20, as shown and may also be constructed of a heat shrinkable Teflon (trade mark) material which extends from the distal end of cable assembly 10 to a position adjacent coupling means 14. The coupling means 14 is located at the proximate end of outer cover 22 and includes a longitudinal groove 24 for alignment with a mating rib in a viewing means or in a strain relieve unit for connection to a viewing means. It can be made of any suitable material, such as anodized aluminium or a machinable grade of plastics, such as Bakelite (trade mark).

A strain relief unit 11 is also illustrated in Figure 1 which can be used to connect the endoscope either to a console or to an eyepiece, as will be more fully explained below. The strain relief unit 11 has a cylindrical body 26 having a fist tapered section 28 and a second smaller tapered section 30, as shown. The second tapered section 30 terminates at its distal end in a socket 32 having a longitudinal rib 34 alignable with groove 24 and held in place by locking nut 36. The other end of strain relief unit 11 has a male connector 38 which is receivable in a console or an emergency use eyepiece, as will be described more fully below. By having the strain relief unit 11 removable from

endoscope C, it is possible to withdraw a trochar through which the endoscope may extend, also as explained below.

In addition, the endoscope can be connected to a eyepiece E as shown in Figure 2. The eyepiece E has a coupling means identical to that of strain relief unit 11 so that it can be coupled to endoscope C. It has a socket 32′ with a longitudinal rib 34′ which is alignable with the groove 24 of coupling means 14. Thus, the coupling means can be slid into the socket as best seen in Figure 2 and held in position by threaded locking nut 36. The proximate end of coupling means 14 and the fibres are flat and polished so as to come into contiguous face-to-face contact with a rod lens 40 for transmitting the light from the coherent fibre bundle to the user's eye which is held against the ocular face 42. The alignment of groove 32′ with rib 34′ ensures that the image being transmitted by the coherent optical bundle 16 is in proper orientation with respect to lens 40 of eyepiece E. Light fibres 44 surround lens 40 and extend to a fixture 46 to which a suitable light source can be attached for illuminating the body cavity by transmitting light along fibres 44 and light bundles 20.

Because coupling means 14 has a diameter no larger than that of outer cover 22, it can be used in a more versatile manner than heretofore possible. Figure 3 shows a trochar 50 which is illustrated as being inserted through the wall 52 of a body member and into a body cavity 54. The trochar has a first lumen 56 through which the endoscope C extends into the body cavity 54. A second lumen 58 is provided for any one of a number of purposes, such as for irrigation or treatment within the body cavity 54. As is well known, trochars of this type may have more than two lumens, depending on their intended use.

After the procedure is completed through lumen 58, it may be desirable to remove trochar 50 while leaving endoscope C in place for further viewing. This is possible using either the eyepiece of Figure 2 or the video console of Figure 3.

If an eyepiece E is used, such as one of the form shown in Figure 2, it can be removed by removing locking nut 36 and sliding the coupling means 14 of the endoscope out of socket 32′. Since the coupling means 14 is no larger in diameter than outer cover 22, the trochar can be slid to the right, as viewed in Figure 3, while leaving endoscope C in place. After removal of trochar 50, the eyepiece E can be reconnected to the coupling means 14, as previously described. The surgeon can then resume his viewing of the body cavity, as required.

Conveniently, the endoscope can also be used with a video console V, of the type shown in Figure 3. This console includes a video screen 60. The coupling means 14 of endoscope C is receivable in a socket 62 which is connected to a camera 64 by suitable optics 66 which includes a continuous focus zoom lens for transmitting the image to camera 64. A light source (not shown) is provided and is connected to optics 66 by light cable 70. It is contemplated that endoscopes of different diameters may be used for different purposes. Thus, socket 62 can be provided in a disc 72 which is mounted for rotation on the video console V about an axis 74 and is provided with a plurality of other sockets, such as sockets 76,78 and 80, as shown. The socket corresponding to the size of the endoscopes can be rotated to be in the position of socket 62, so as to be properly aligned with the optics 64.

An important advantage is that when a cable assembly 10 of the endoscop becomes damaged and no longer usable, it can be replaced with another one without having to replace a corresponding eyepiece. Furthermore, the endoscope can be made to be moisture-impervious so that it can be easily sterilized for re-use. When used with a console, the sterility of the operating environment can be maintained since the surgeon does not need to put the eyepiece against his face. Furthermore, when the device is used with the video monitor V, should there be a power interruption or should the video camera or monitor malfunction, it is merely necessary to slip the coupling means 14 of the endoscope out of its socket, such as socket 62, and attach a sterilized eyepiece E, which would be provided to the surgeon, so that we can continue with the operation or procedure with minimal interruption.

In another arrangement, shown in Figure 5, endoscope C extends through a maleable sheath 82 which extends through a body canal 84 and is conformed to the shape of the canal. In addition to endoscope C, the sheath 82 may include a laser fibre 86 for phototherapy or photocoagulation treatment within the body cavity into which the sheath and endoscope extend. Additionally, it may include a passageway 88 for irrigation or suction.

A video console V′ is shown in Figure 7 which is specifically constructed for use with the strain relief unit U which couples endoscope C to the console. In this arrangement, a video monitor 90 is provided as a separate unit and is connected to the console by a signal transmitting cable 92. The console V′ has a front panel 94 which contains the controls for the monitor camera, light source and filters, as well as a receptacle 96 for receiving strain relief unit U. As best seen in Figure 8, the receptacle 96 is connected by means of a light cable 98 to a light source 100. The receptacle 96 is also connected to an optical assembly 102 which transmits the image from the cable to camera 104

for transmission by cable 92 to the monitor 90. The camera is connected to a camera power supply 106 and the lamp assembly is powered through light source power supply 108. A suitable power transformer 110 and fans 112 and 114 are provided.

Returning now to Figure 1, the male connector 38 carries an optical bundle 116 through the centre thereof which aligns with the optical bundle 16 in endoscope C at socket 32 and is polished at both ends so that light will be transmitted from one bundle to the next. A flat face 118 radiates outwardly from connector 38 to the peripheral surface of cylindrical body 26. The ends of light transmitting fibres 120 are spaced around this face and also have polished ends, the opposite ends thereof being aligned with the ends of light bundles 20 of endoscope C. Alignment pins 122 are provided on opposite side of connector 38 to align the light bundles and optical bundles with the corresponding light transmitting fibres within video console V'.

Turning to Figure 9, it can be seen that within receptacle 96 are spaced light bundles 124 which align with light bundles 120. These light bundles are fed through light cable 98 to light source lamp assembly 100. Thus it can be seen that the light will be transmitted via all these light bundles from the light source lamp source assembly to the end of endoscope C for illuminating the area to be viewed. The image will be transmitted through the optical bundles, as described, to the optical assembly 102 and camera 104. Conveniently, connector 38 has a peripheral recess 126 for receiving a spring detent 128 in the receptacle 96 and thereby releasably holding the strain relief unit U in place in socket 129.

An eyepiece E' as shown in Figures 10 and 11 can be connected to strain relief unit U as shown. The eyepiece includes a socket or receptacle 130 in which the male connector 38 extends. The light bundle thereof is aligned with lens 132 whereby the image is projected through glass window 134 onto the eye of the surgeon. The eyepiece E' is also provided with a light fixture 136 through which a bundle of light transmitting fibres 138 extends and terminates in peripherally spaced positions around the fact of the eyepiece for alignment with the light bundles 120 of strain relief unit U. As best seen in Figure 11, a spring detent 140 extends into the peripheral groove 126 of male connector 38 and releasably holds the strain relief unit and eyepiece E' together.

Another form of the endoscope is shown at C' in Figures 12 to 16 and has an integral strain relief unit U'. The length of this device is approximately 190.5 centimetres (75 inches) to 203 centimetres (80 inches) in length and is very flexible. The tapered section is capable of accepting endoscopes of different diameters in the distal end. Each endoscope in Figures 12,14,15 and 16 has a different tip. A general purpose tip 142 is shown in Figure 12. This tip may be the same diameter as the endoscope or enlarged, as shown. The tip may include a stainless steel jacket 144, as best seen in Figure 13, or it may not have a metal covering at all and be very flexible. As can be seen from Figure 13, within the jacket 144 is optical bundle 16 having a cover 18 and surrounded by spaced light bundles 20. Conveniently, a lens 146 is provided at the end of optical bundle 16 for focussing an image of the site being investigated on to the end of light bundle 16 for transmission to the viewing means.

In Figure 14 a long straight probe 148 is illustrated which may be a stainless steel jacket made of #304 tempered stainless steel. Also, #316, #316L and INCONEL 600 (trade mark) steel may be used. This device may be used for insertion into various body passageways which are relatively straight. Alternatively, a maleable jacket 150 (shown in dotted lines) may be used which can be conformed to the passageway through which it is to extend. Such usage of this device might be as an arthroscope and the maleable material may be sterling silver. With this device the surgeon can bend it to fit his needs to see a particular part of the joint in which it is used. After the procedure is completed, it can be straightened for use in the next succeeding case. In small joints, such as a finger joint, the device might be approximately 1.0 mm in diameter. If it is intended for use in examining an ankle joint it might be 2.0 mm in diameter. For still larger joints like a knee joint, it might be 3.5 mm to 5.0 mm in diameter, or possibly larger. The metal sleeve can be approximately 15 centimetres (6 inches) to 20 centimetres (8 inches) in length. In the maleable device, a maleable form of stainless steel might be used instead of sterling silver. A closely wound steel spring of appropriate length may be provided to slip over the maleable section to aid the surgeon to shape this section to desired configuration without crimping. This steel spring is them removed after shaping and set aside.

If the device is used as a hysteroscope it might be made less than 1.0 mm in diameter. This size is selected to allow passage of the device into the cervical canal without dilating the cervix. If made this small, the endoscope can be passed into the cervix along with other devices such as a special fibre-optic, possible of 200 to 400 microns diameter, for transmitting laser energy for photocoagulation as previously discussed with respect to Figure 5. A channel for either suction or irrigation can be provided. With the maleable sheath, the device can be preformed to the shape of the particular uterine cavity in which it is being used.

In the embodiment of Figure 15 an optical probe 152 is illustrated which has a rigid body portion 154 with a hand grip 156 and a curved rigid probe 158 which allows the physician directional stability so that he can point the device wherever he wants it to look around other body portions.

A still further embodiment is shown in Figure 16 wherein the endoscope C' extends into a protective stainless steel housing 160 which is attached to the side of a pair of forcepts 162, such as a laryngeal grasping device which might be used to extract a fish bone from the larynx. The metal tube is welded or otherwise attached to lower jaw 164 of the instrument. The upper jaw 166 can be moved relative to jaw 164 by squeezing handles 168 and 170 respectively. Thus, when the physician inserts the grasping device into the throat patient he can look around and determine where the lodged object is.

It will be understood that other uses will become apparent to one skilled in the art in addition to those illustrated.

With slight modification, the endoscopes described and the console can be used as a fluorescence detector and provide a means for not only detecting abnormal cells but also for treating the cells by phototherapy and measuring the effectiveness of that treatment. In this regard the patient is given a drug which has a particular affinity to the abnormal cells and which will fluoresce when exposed to light of a predetermined first frequency. This light frequency can be transmitted through special light fibres of the endoscope onto the tissue being examined. When fluorescence is viewed on the monitor or with the eyepiece, the surgeon will know that this is a site of abnormal cells. Light of a second frequency which will kill the cells can be directed down the light fibres or through a separate and additional light fibre. If even a third light channel is provided, to permit the use of other light frequencies, various quantitative measurements can be done through the endoscope. In some situations, strobed light may be used.

One drug that has been found to be ideal for detecting abnormal calls, such as cancer cells, is a hematoporphyrin derivative (HPD). When exposed to a light frequency between 400 nm and 410 nm it will fluoresce to a salmon pink colour having a wavelength of 630 nm. If the tumour containing the drug is then exposed to an external laser frequency of 630 nm the cancer cell is destroyed with no harm to surrounding normal cells. This is referred to as HPD phototherapy. The cancer cells are destroyed because the 630 nm light causes a change in the oxygen in the cell to a form called "singlet oxygen" which is toxic to the cell. The oxygen content of the cell can be monitored by utilizing laser light to measure absorption spectra and by a spectrophotometer. Turning to Figure 8, it will be apparent that the lamp and light source lamp assembly 100 can be changed, such as to a halogen light which provides a frequency in the visible range, or alternatively a band pass filter 172 can be inserted which allows transmission of only those light rays which fall within the desired frequency. The fluorescing cells will then transmit light through the optical assembly to camera 104. Again, a second band pass filter 174 can be inserted between the optical assembly and the camera which allows transmission only of the reflective fluorescent light in the range of 630 nm. Also, various electronic equipment, known in the art for image processing and image enhancement to increase the brilliance of such an image, can be utilized to make the fluorescing cells clearly visible to the physician on the video monitor 90. Furthermore, band pass filter 172 can be replaced by other filters, such as to permit transmission of light having a different frequency from the range 630 nm. The two frequencies of 410 nm and 630 nm can be strobed so that they are alternately sent along the light fibres for fluorescence and for killing the cells, respectively.

Although a particular photochemical material and light range has been described, it will be understood that other photochemical materials may give off other light frequencies which could be anywhere from the infrared frequency through the visible frequency to the ultraviolet frequency. In addition to a halogen light source, a mercury vapour light source or a xenon light source could be used with the band pass filters.

In addition, the endoscope can be changed to provide fibres which are particularly effective for transmitting light in the 400 nm to 410 nm frequency range. Such fibres are available through Galileo Electro-Optics Company of Sturbridge, Massachusetts, U.S.A. and other manufacturers. Another fluorescence detector compound which has been found effective is Rhodamine-123.

Form the foregoing, it will be apparent that an endoscope has been described which has great versatility in that it may be used with either a substantially standard eyepiece or with a video camera and monitor. The endoscopes described can be provided in different sizes when used with a video monitor, which may contain a plurality of sockets for alignment with the optical means of the video camera for connection with a endoscope of the selected size. Furthermore, the endoscope can be used within the lumen of a trochar or operating channel of a larger endoscope and. since the eyepiece is removable, the trochar or larger endoscope can be removed without removing the basic endoscope and the eyepiece can then be replaced for further viewing. The endoscope can be

easily replaced should it become damaged, without replacement of the expensive viewing means. Also, the sterility of the endoscope can be maintained when used with the console, which permits its use with a lower risk of infection. Furthermore, no separate light cable is needed.

The device can also be used for detection and treatment of cancer cells or other abnormal cells by using it to excite a fluorescent dye in the abnormal cell by excitation with a selected laser light. The fluorescence will give off its own light which can be detected and displayed on the video monitor whereupon a laser light of the same frequency can be transmitted back to the cell and used to convert the oxygen in the cell to singlet oxygen thereby destroying the cell. The effect of the phototherapy can be monitored by photometric means.

From the foregoing it can be seen that a method of using a sterilized endoscope for viewing and/or treatment within body cavities has also been described which includes inserting the distal end of the endoscope into a body cavity, attaching a first removable optic means to the coupling means to view the body cavity, disconnecting the first removable optic means from the coupling means, and attaching a second removable optic means to the coupling means to view the body cavity.

Claims

1. A sterilizable small diameter endoscope for viewing and/or treatment within body cavities by nonsurgical or micro-surgical procedures and having a distal end for insertion into a body cavity and a proximate end, said endoscope being characterised by:-
a coherent fibre optical bundle (16) having a microthin diameter and extending from said distal end to a point adjacent said proximate end and having a planar surface at its proximate end;
a plurality of light transmitting fibres (20) spaced around said optical bundle (16);
a tubular outer cover (22) extending over said fibres (20) to hold them in place, said outer cover (22) extending from said distal end to a point spaced from said proximate end;
optical lens means (12) at said distal end of said optical bundle (16) to focus an image of a portion of the cavity on said distal end of said optical bundle (16) for transmission through said optical bundle (16); and
a coupling means (14) for removably connecting the endoscope to a viewing means (E,V) in fixed angular relationship, the coupling means being fixedly attached at said proximate end of said endoscope and having a diameter no larger than the diameter of said outer covering (22) so that the endoscope can pass completely through a trochar lumen (56) or operating channel of a larger endoscope.

2. An endoscope as claimed in Claim 1, characterised in that said coupling means (14) includes alignment means (24) to angularly align the optical bundle (16) with the viewing means (E,V).

3. An endoscope as claimed in Claim 2, characterised in that said alignment means includes a longitudinal groove (24) extending along said coupling means (14) for alignment with a longitudinal rib in the viewing means (E,V).

4. An endoscope as claimed in Claim 2 or 3, characterised in that said viewing means includes a removable eyepiece (E) having a socket (32') for slidably receiving said coupling means (14) in aligned relationship for viewing;

5. An endoscope according to claim 2 or 3, characterised in that said viewing means comprises a console (V,V') containing optics and a viewing screen (60,90) having a socket for slidably receiving said coupling means (14) for viewing the body cavity on said viewing screen (60,90).

6. An endoscope as claimed in Claim 5, characterised in that said console includes a rotatable member (72) having a plurality of sockets (76,78,80) spaced therearound and selectively alignable, each socket (76,78,80) being of a different diameter for accommodating endoscopes of different diameters.

7. An endoscope as claimed in any preceding claim, characterised by a strain relief unit (11,U) having a first smaller end (32) for receiving said coupling means (14) in aligned relationship and having a second larger end with a male connector (38) for reception in optical alignment in a receptacle of a viewing means (E,V).

8. An endoscope as claimed in Claim 7, characterised in that said strain relief unit (11,U) includes:
a bundle of optical fibres (116) extending longitudinally therethrough to each end which are alignable with light fibres (16) in said endoscope; and
alignment pins (122) adjacent said male connector (38) to align said bundle of optical fibres (116) in said unit with the viewing means (E,V).

9. An endoscope as claimed in Claim 8, characterised in that the strain relief unit (11,U) includes a body portion (26) having a greater diameter than said male connector (38) and forming a planar radial face (118) at the juncture between said body (26) and said connector (38), light transmitting fibres (120) being spaced around said optical fibres (116), each light transmitting fibre (120) terminating at a polished end at spaced points around said face (118) for alignment with similar light fibres (138) in the viewing means (E,V).

10. An endoscope as claimed in Claim 9, characterised by a tapered section (30) joining said body (26) and said smaller end (32).

11. An endoscope as claimed in any preceding claim, characterised by a stainless steel jacket (144) encasing the distal end of the endoscope.

12. An endoscope as claimed in Claim 11, characterised in that said jacket (144) is rigid.

13. An endoscope as claimed in Claim 11, characterised in that said jacket (114) is maleable to assume the contour of the body canal in which the endoscope is placed.

14. An endoscope as claimed in Claim 11, characterised in that said jacket (160) is attached to a pair of forceps (162).

15. An endoscope as claimed in Claim 11, characterised in that said jacket is in the form of an optical probe (152) having an angular bend.

16. An endoscope as claimed in Claim 4, characterised in that said console (V') includes:
an optical assembly (102) including a receptacle (96);
a light source (100:
light fibres (98) for transmitting light from said light source (100) to points spaced around said receptacle (96);
a camera (104) aligned with said optical assembly (102) for receiving images from the optical bundle (16) of the endoscope; and
a video monitor (90) connected to said camera (104) for displaying the images.

17. An endoscope as claimed in Claim 16, characterised in that said console (V') further includes band pass filter means (172,174) to allow transmission of a selected light frequency.

18. An endoscope as claimed in Claim 17, characterised in that said band pass filter means includes:
a first band pass filter (172) between said light source (100) and said light fibres (98) to allow transmission of a selected light frequency through said endoscope to cause fluorescence of cells to be treated; and
a second band pass filter (174) between said optical assembly (102) and said cameral (104) to allow transmissions of the fluorescence frequency only to the camera (104) for display by said video monitor (90).

19. A method of using a sterilizable endoscope for viewing and/or treatment within body cavities (54, 84) by nonsurgical or micro-surgical procedures which has a distal end (12) for insertion into the body cavity and a proximate end with coupling means (14) of no greater diameter than the body of the endoscope, said method being characterised by the steps of:
inserting the distal end (12) into the body cavity (54,84);
attaching a first removable optical viewing means (E,V) to the coupling means (14) to view the body cavity (54,84);
disconnecting the first removable optical viewing mkeans (E,V) from the coupling means (14); and
attaching a second removable optical viewing means (E,V) to the coupling means (14) to view the body cavityt (54,84).

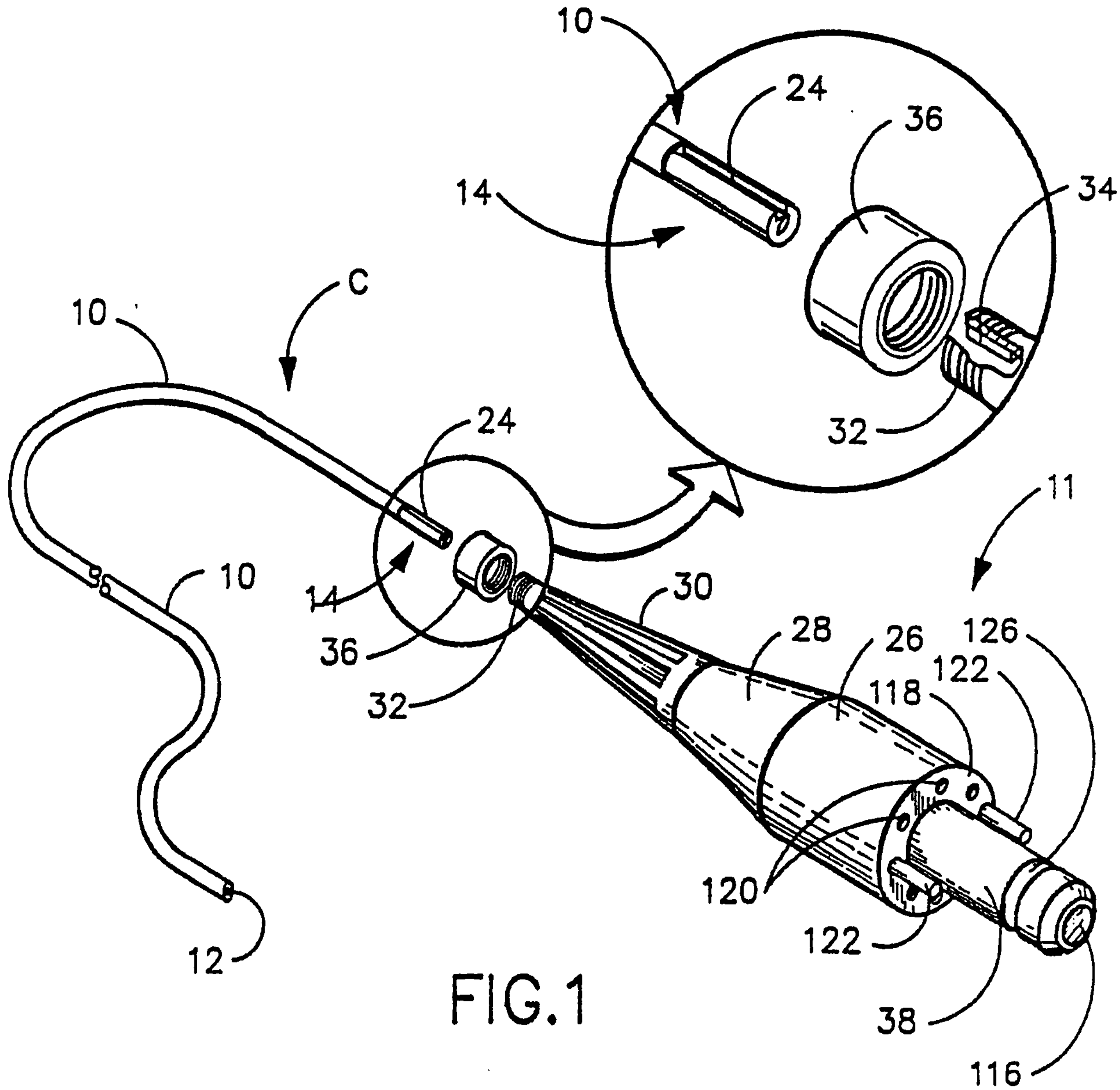
20. A method of using a sterilizable endoscope for viewing and/or treatment within body cavities (54,84) by nonsurgical or micro-surgical procedures which has a distal end (12) for insertion into the cavity (54,84) and a proximate end with coupling means (14) of no greater diameter than the body of the endoscope, said method being characterised by the steps of:
inserting a trochar (52) into the body cavity (54,84);
inserting the endoscope into the body cavity through the lumen (56) of the trochar (50);
attaching a removable optical viewing means (V) to the coupling means (14);
viewing the body cavity (54,84) through the endoscope via the optical viewing means (V);
disconnecting the optical viewing means (V) from the coupling means (14);
removing the trochar (50) over the coupling means (14) while leaving the endoscope in place;
re-attaching the optical viewing means (V) to the coupling means (14); and
resuming the viewing of the body cavity (54,84) through the endoscope via the optical viewing means (V).

21. A method of detecting abnormal cells in a patient, characterised by the steps of
giving the patient a fluorescent drug which localizes in the abnormal cells;
irradiating the body area containing the abnormal cells with a light of a first frequency which will cause the abnormal cells to fluoresce; and
treating the abnormal cells by irradiating them with laser light of a second frequency to destroy the abnormal cells.

22. The method as claimed in Claim 21, characterised by the step of observing the change in absorption patterns of laser light by the abnormal cells or substances.

23. The method as claimed in Claim 21 or 22, wherein:
said drug is a derivative of hematoporphyrin;
said first light frequency is in the range of 400 nm to 410 nm; and
said second light frequency is 630 nm.

24. A method as claimed in any one of claims 21 to 23, characterised in that said second frequency is the fluorescing frequency.


10
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122
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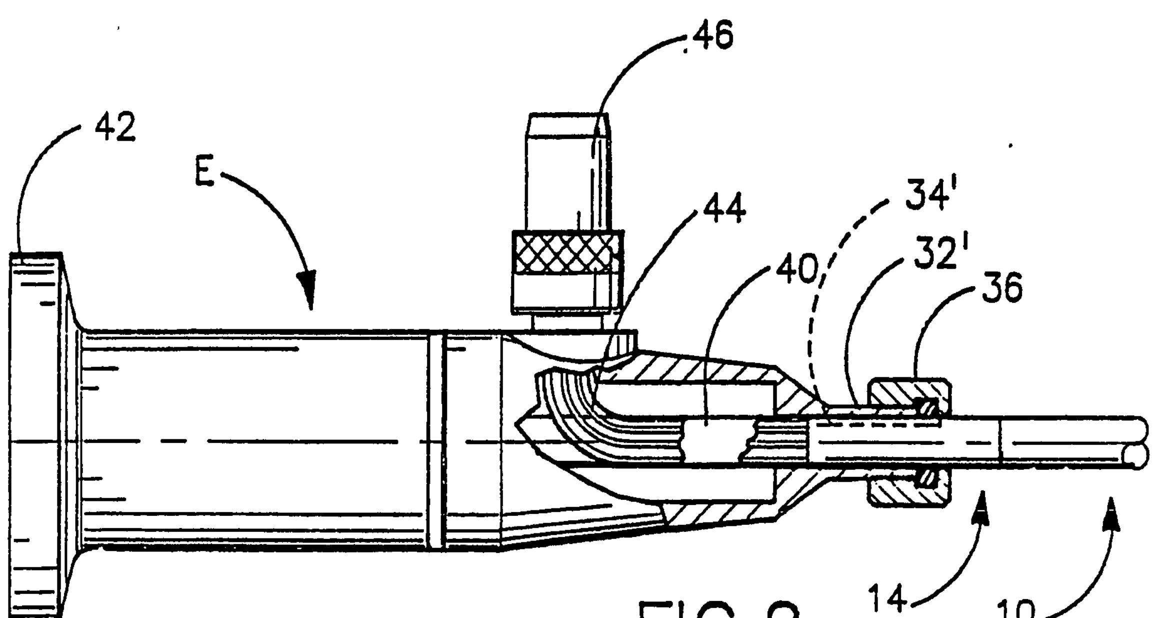
116
12

FIG.1


46
42
E
44
34'
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32'
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14
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FIG.2

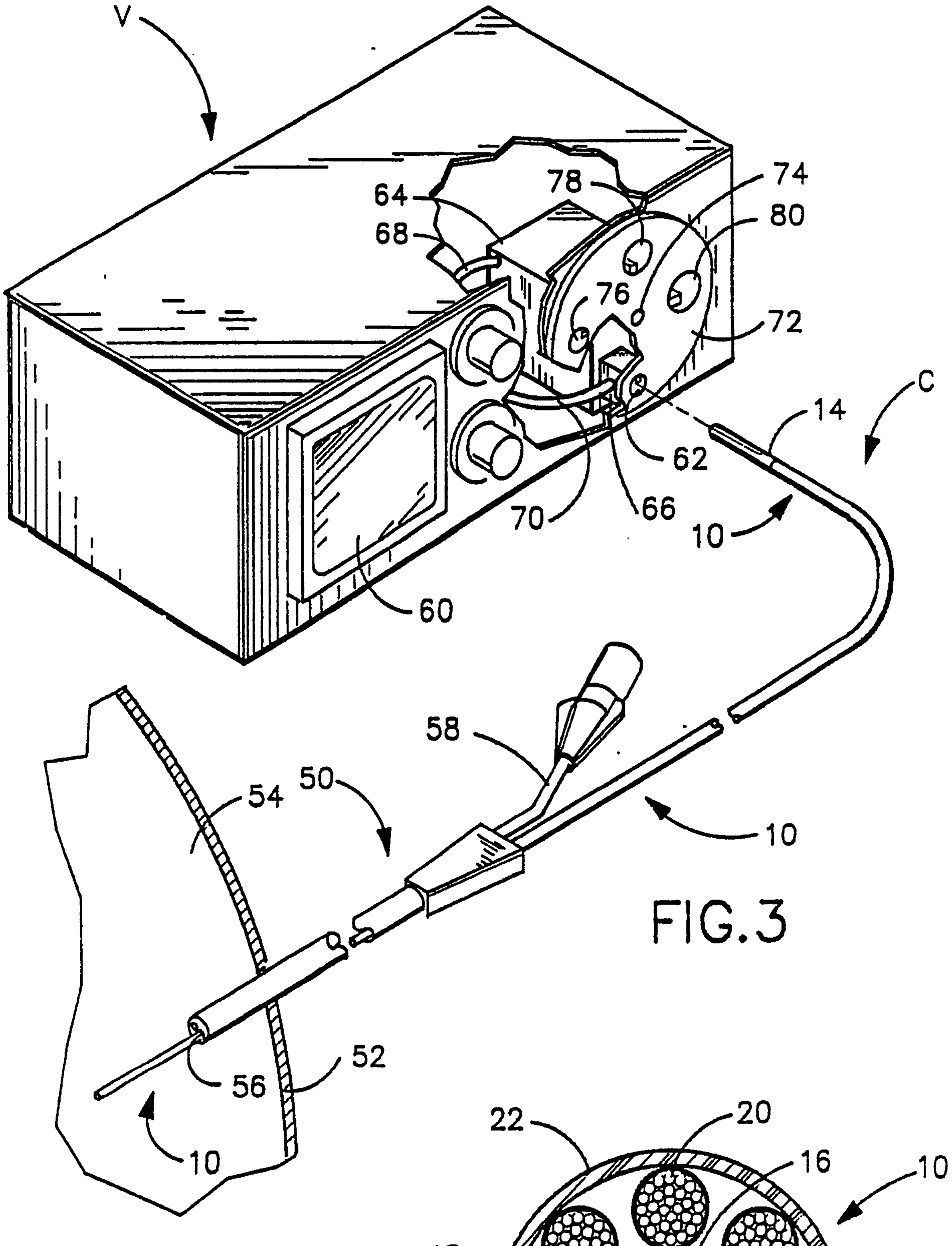
V
64
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FIG.3

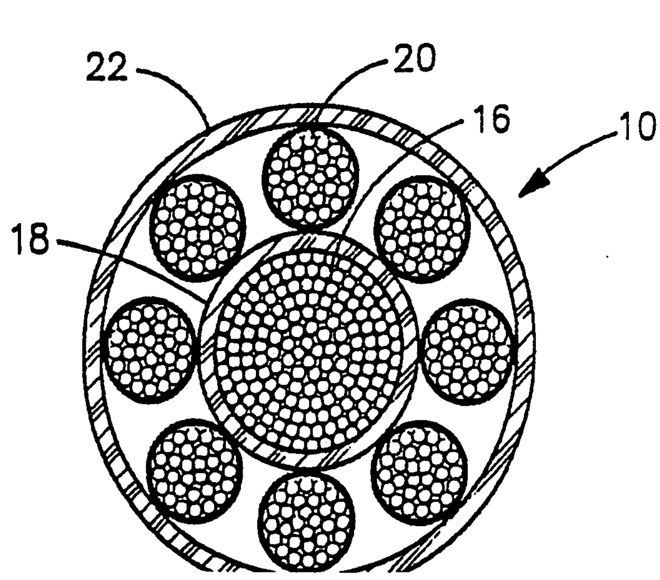
22
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FIG.4

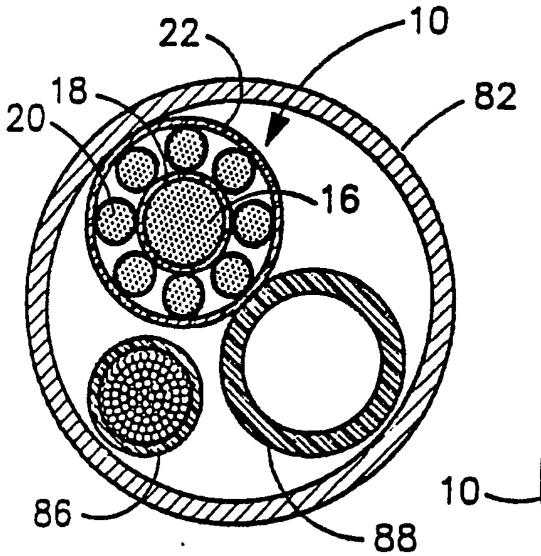

FIG.6

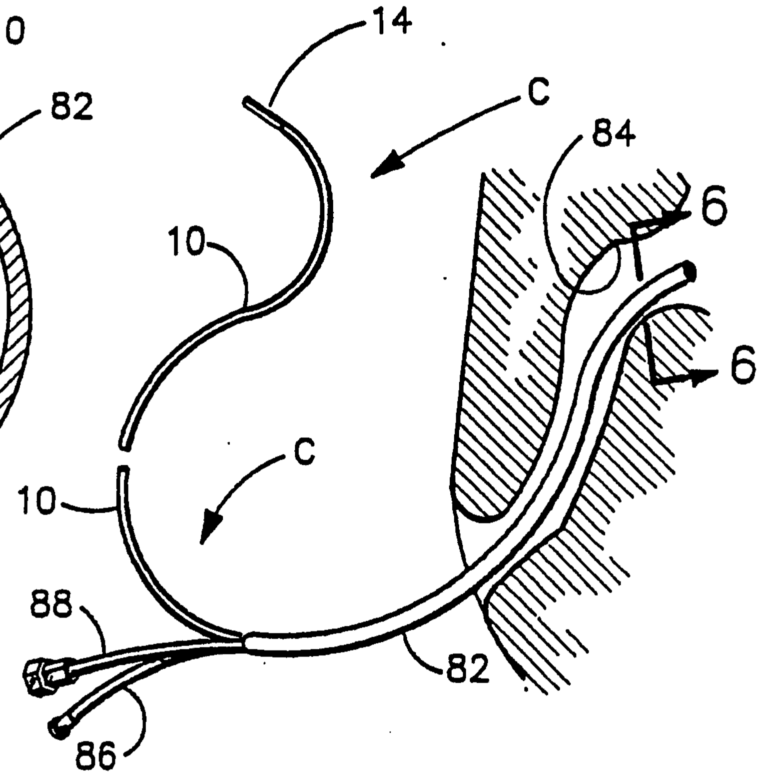

FIG.5

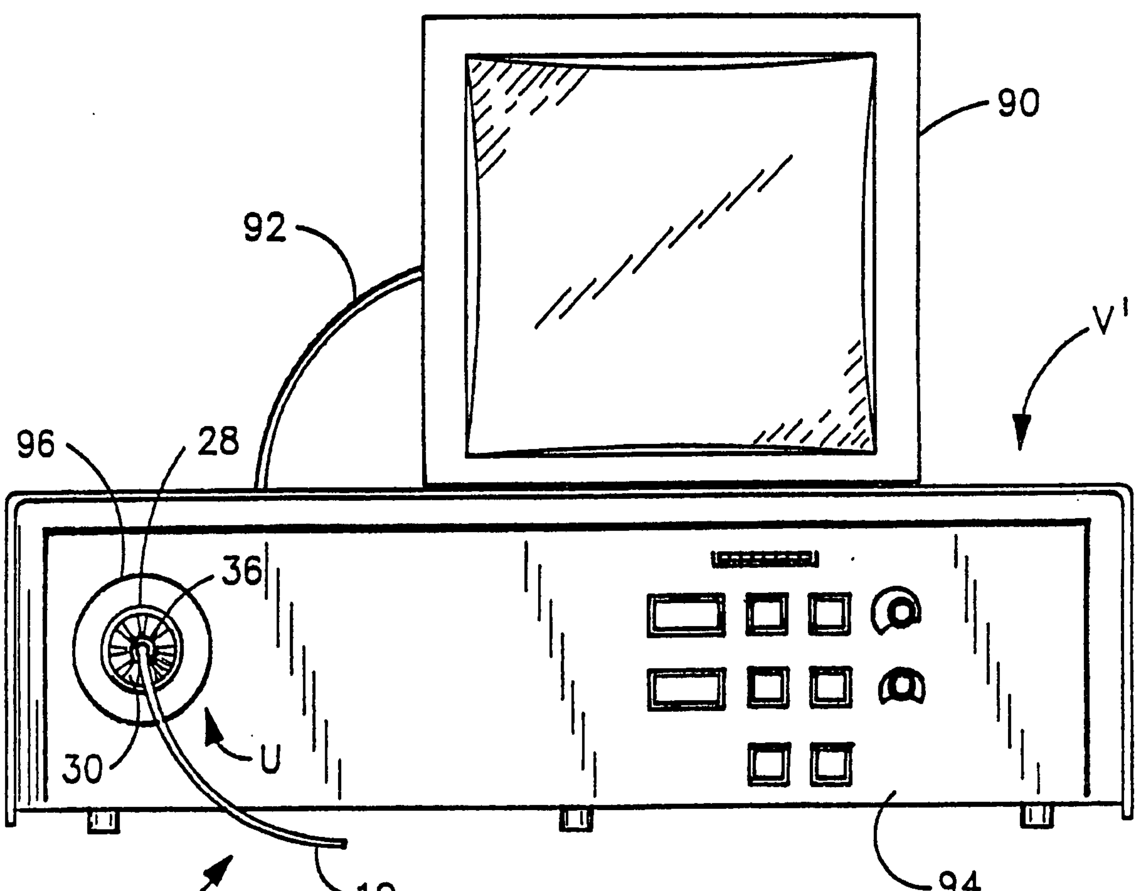

FIG.7

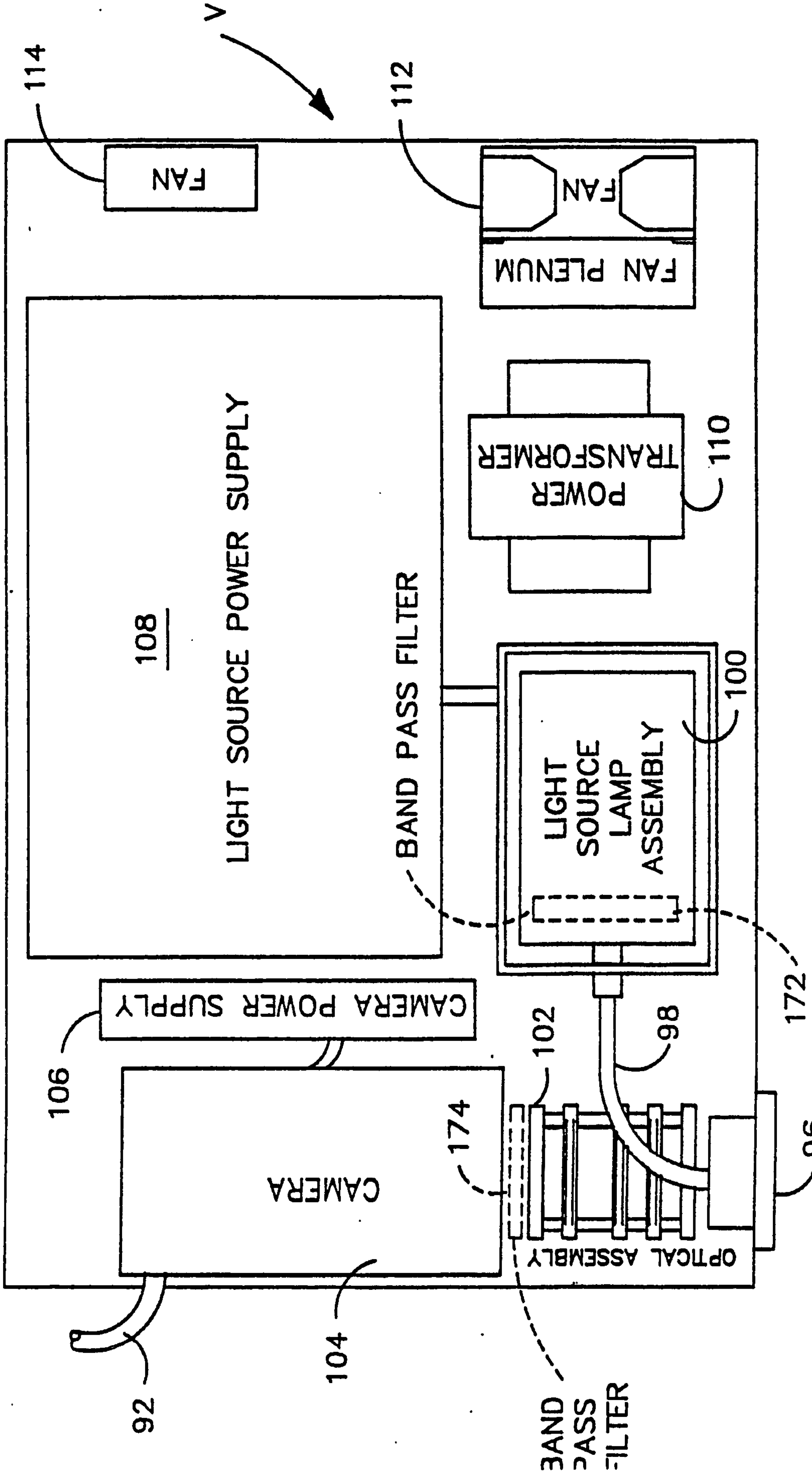
V'
114
FAN
112
FAN
FAN PLENUM
108
LIGHT SOURCE POWER SUPPLY
POWER
TRANSFORMER
110
BAND PASS FILTER
LIGHT
SOURCE
LAMP
ASSEMBLY
100
172
CAMERA POWER SUPPLY
106
102
98
CAMERA
174
96
OPTICAL ASSEMBLY
104
92

FIG.8

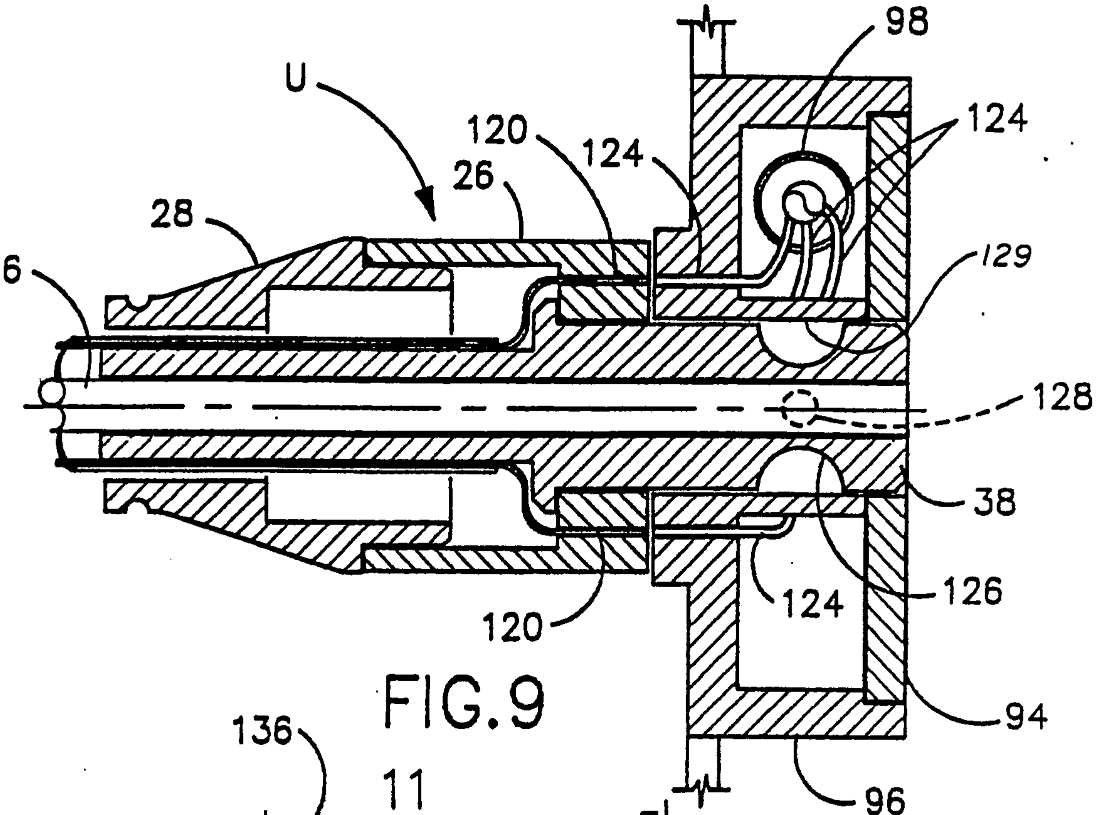

FIG.9

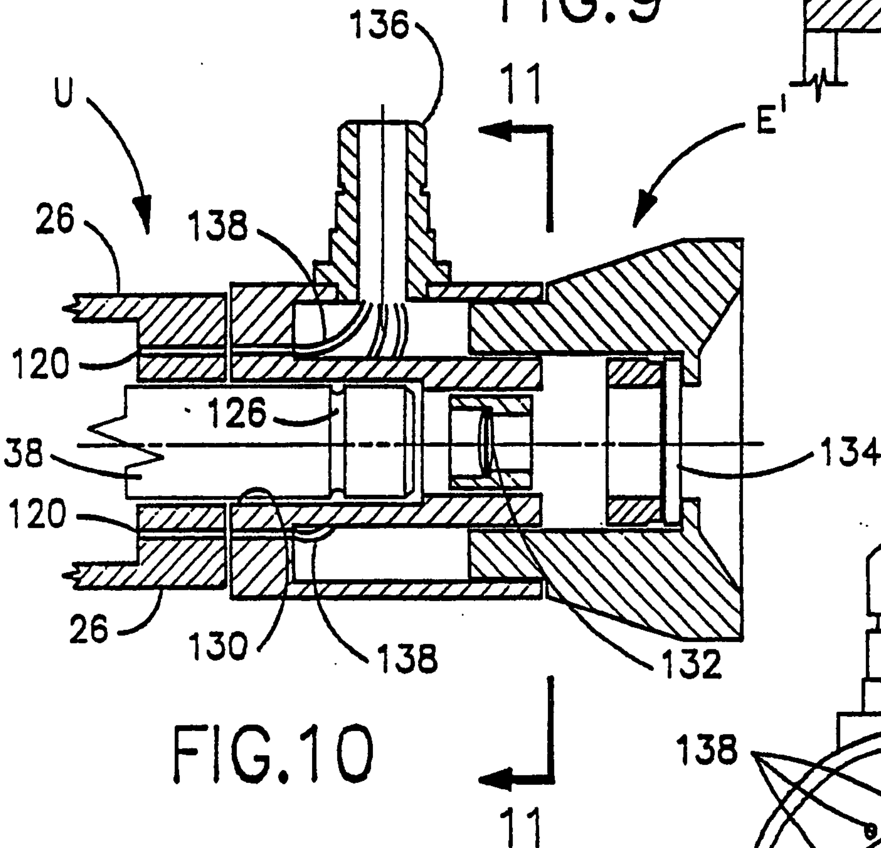

FIG.10

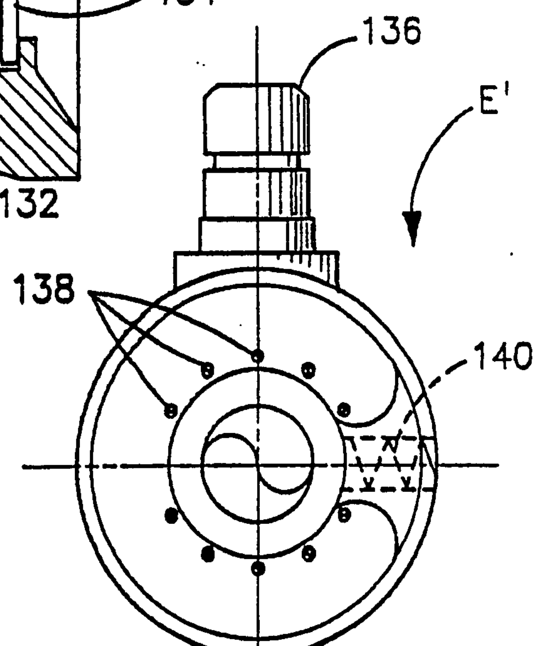

FIG.11

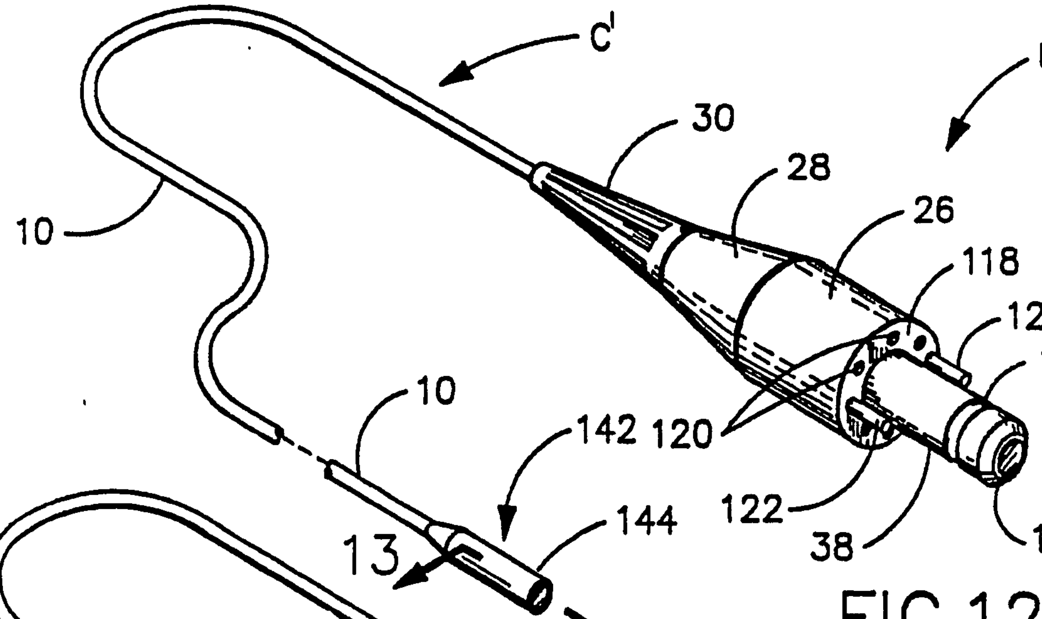

FIG.12

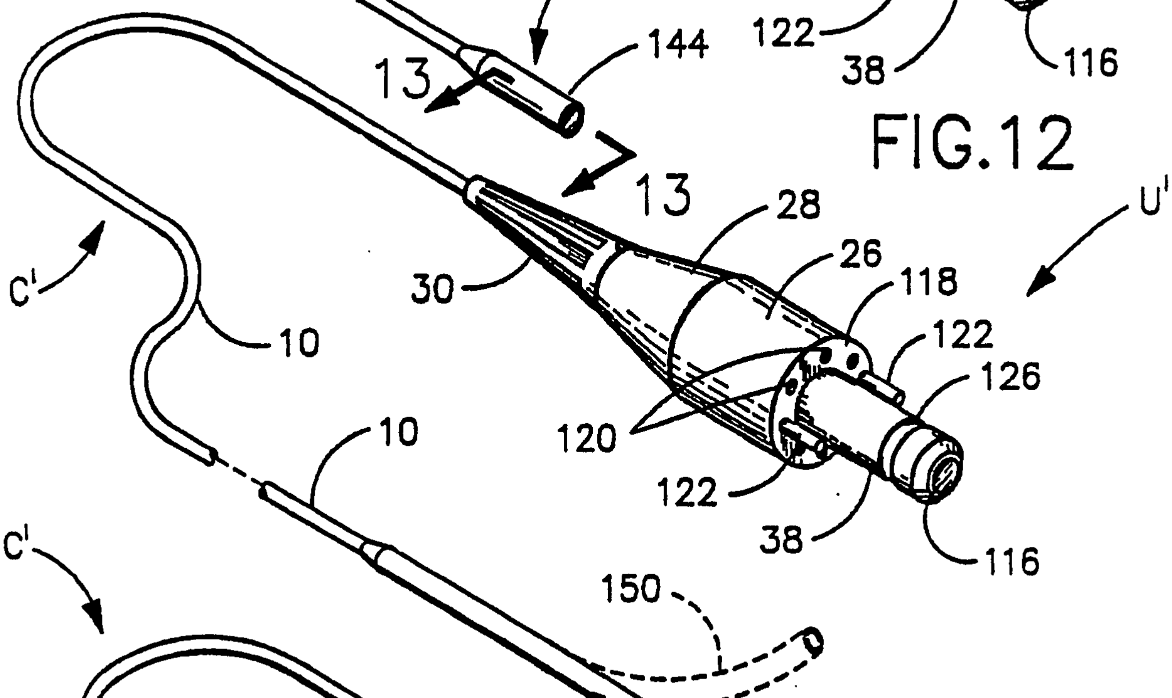

FIG.14

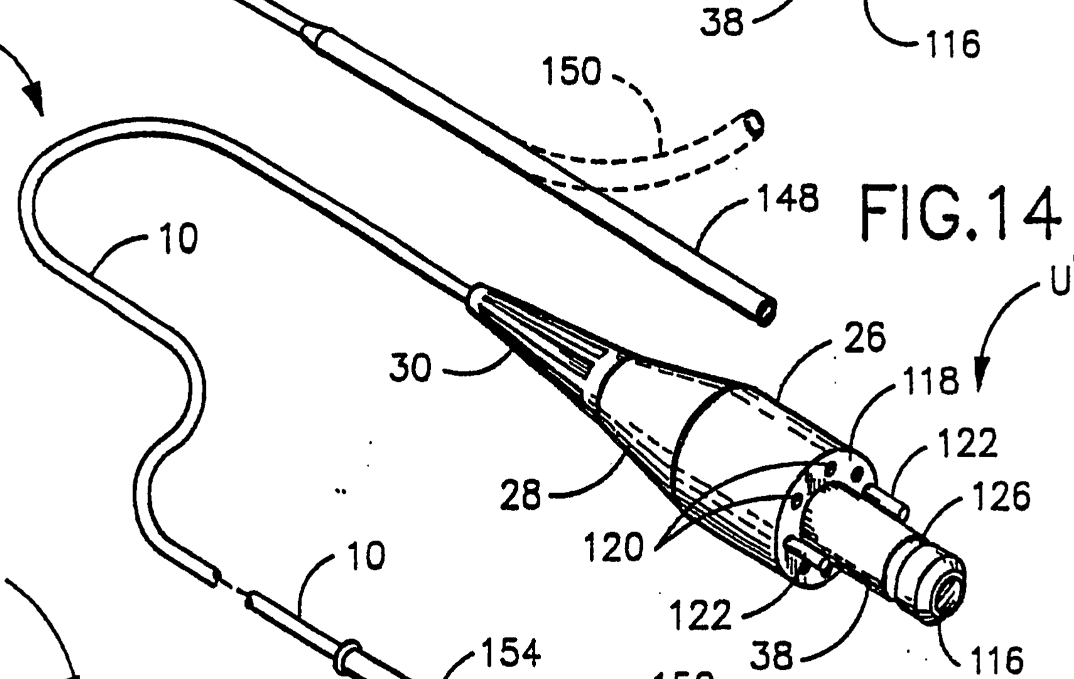

FIG.15

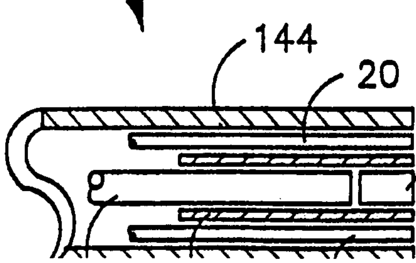

FIG.13

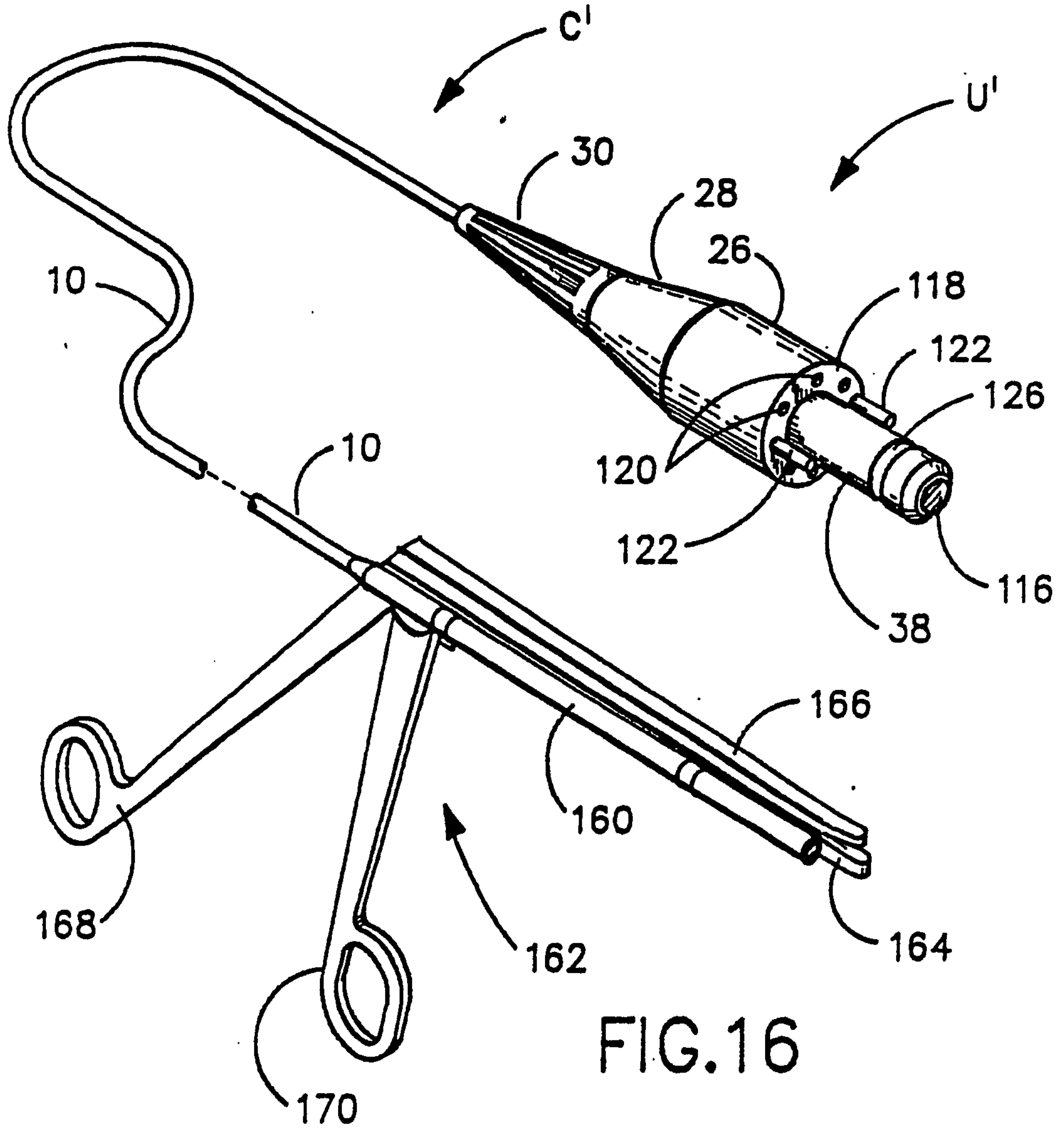
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FIG.16